SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Oak Lake, Brookings County
2102-F-21-R-48
2015

Figure 1. Oak Lake, Brookings County

Legal Description: T110N- R48W-Sec 1, 12, 13; T112N-R47W-Sec 7, 18
Location from nearest town: 6 miles north and 5 miles east of White, SD

Surface Area: 396 acres
Meandered (Y/N): yes
OHWM elevation: 1802.3
Outlet elevation: 1801.8
Max. depth at outlet elevation: 6 feet
Observed water level: insert
Contour map available (Y/N): yes

Watershed area: 4,480 acres
Shoreline length: no data
Date set: 1983
Date set: 1983
Mean depth at outlet elevation: 4 feet
Lake volume: 1,560 acre feet
Date mapped: 1956

DENR beneficial use classifications: (6) Warmwater marginal fish propagation, (7) immersion recreation, (8) limited-contact recreation, (9) fish and wildlife propagation, recreation, and stock watering

Introduction

General

Oak Lake is located in the northeast corner of Brookings County on the east slope of the Coteau des Prairie. It was named for the abundance of oak trees surrounding the shoreline. The lake receives its water from watershed runoff and a limited aquifer connection. Overflow runs northeast into Fish Lake in Deuel County then east into Minnesota.

Ownership of Lake and Adjacent Lakeshore Properties

Oak Lake is listed is a meandered lake in the State of South Dakota Listing of Meandered Lakes and the South Dakota Department of Game, Fish and Parks (GFP) manages the fishery. GFP owns and manages a small lake access area on the northeast corner of the lake. Much of the west shoreline is owned by South Dakota State University and occupied by the Oak Lake Field Station. The remainder of the shoreline is privately owned.

Fishing Access

The relatively new Oak Lake Access Area has a single lane, concrete plank boat ramp, boat dock and concrete vault toilet. Shore fishing opportunity is limited to the access area. The lake is a popular ice fishing location for walleye and yellow perch.

Water Quality and Aquatic Vegetation

Water temperature was normal (26 ^{o}C, 80 ^{o}F) for mid-July. Extensive beds of sago pondweed (*Potamogeton pectinatus*) were observed in the shallow north end of the lake (Table 1). Water clarity improved from previous years, with a Secchi depth of 122 cm (48 in.)

Table 1. Water temperature, Secchi depth and observations/comments on water quality and aquatic vegetation in Oak Lake, Brookings County, 2006-2015.

Year	*Water Temp ^{o}C (^{o}F)*	*Secchi Depth cm (in)*	*Observations/Comments (algae, aquatic vegetation, water quality, etc.)*
2015	26 (80)	122 (48)	Sago pondweed, cattail, bulrushes
2014	20 (68)	35 (14)	Sago pondweed beds at north end
2012	27 (81)	13 (5)	No observations of aquatic vegetation were recorded
2009	-- (--)	76 (30)	Sago and clasping leaf pondweed, coontail, bladderwort
2007	23 (73)	30 (12)	Sago pondweed

Fish Community

Game species found in Oak Lake include walleye, yellow perch, northern pike and black bullhead (Table 2). Other species include common carp, white sucker, and bigmouth buffalo.

Table 2. Fish species commonly found in Oak Lake, Brookings County.

Game Species	***Other Species***
Walleye	Common Carp
Yellow Perch	White Sucker
Northern Pike	Bigmouth Buffalo
Black Bullhead	

Fish Management

Oak Lake is relatively shallow making it susceptible to frequent fish kills (Table 3). When water levels allow, walleye and yellow perch are stocked in an effort to maintain fishing opportunity (Table 4).

Table 3. Fish kill history for Oak Lake, Brookings County.

Year	***Severity***	***Comments***
2001	Light	Winterkill – yellow perch, black bullhead, northern pike, saugeye
2004	Moderate	Winterkill – yellow perch and black bullhead
2009	Severe	Winterkill – hundreds of yellow perch observed
2012	Moderate	Summer kill – multiple species due to low dissolved oxygen
2013	Severe	Winterkill – yellow perch, walleye, common carp, black bullhead

Table 4. Stocking history for Oak Lake, Brookings County, 2006-2015.

Year	***Number***	***Species***	***Size***
2006	40,000	Walleye	Fingerling
	4,170	Yellow Perch	Juvenile
2009	20,000	Walleye	Fingerling
	7,153	Yellow Perch	Juvenile
	198,380	Yellow Perch	Fingerling
2010	40,800	Walleye	Fingerling
2012	3,053	Yellow Perch	Adult
2013	39,930	Walleye	Fingerling
	1,440,000	Yellow Perch	Fry
2014	400,000	Walleye	Fry
2015	28,160	Walleye	Fingerling

Methods

Oak Lake was sampled on July 13-14, 2015 with three overnight gill nets. The gill nets were 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh (½, ¾, 1, 1¼, 1½, and 2 in) monofilament netting.

Results and Discussion

Net Catch Results

Black bullhead (56.4%) and yellow perch (41.0%) accounted for the majority of the gill net catch (Table 5). Other species sampled include common carp, walleye, and northern pike.

Table 5. Total catch from three overnight gill nets set in Oak Lake, Brookings County, July 13-14, 2015.

Species	*#*	*%*	*CPUE[1]*	*80% C.I.*	*Mean CPUE**	*PSD*	*RSD-P*	*Mean Wr*
Black Bullhead	238	56.4	79.3	±69.6	77.3	78	0	--
Yellow Perch	173	41.0	57.7	±14.4	40.4	17	0	104
Walleye	8	1.9	2.7	±1.1	11.2	--	--	--
Common Carp	2	0.5	0.7	±0.9	10.7	--	--	--
Northern Pike	1	0.2	0.3	±0.4	2.6	--	--	--

*10 years (2006-2015)

Table 6. CPUE by length category for selected species sampled with gill nets in Oak Lake, Brookings County, July 13-14, 2015.

Species	*Substock*	*Stock*	*S-Q*	*Q-P*	*P+*	*All sizes*	*80% C.I.*
Black Bullhead	--	79.3	17.3	62.0	--	79.3	±69.6
Yellow Perch	2.3	55.3	46.0	9.3	--	57.7	±14.4
Walleye	--	2.7	--	2.7	--	2.7	±1.1
Common Carp	--	0.7	0.7	--	--	0.7	±0.9
Northern Pike	--	0.3	--	0.3	--	0.3	±0.4

Length categories can be found in Appendix A.

Table 7. Gill-net (GN) CPUE for selected fish species sampled in Oak Lake, Brookings County, 2006-2015.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Bigmouth Buffalo		--		--			8.5		4.3	--
Black Bullhead		52.5		38.7			110.5		105.3	79.3
Common Carp		--		--			20.0		11.3	0.7
Northern Pike		5.5		3.3			2.5		1.3	0.3
O. S. Sunfish		0.5		--			--		--	--
Walleye		24.0		10.0			13.0		6.3	2.7
White Sucker		1.0		1.0			0.5		--	--
Yellow Perch		8.0		15.7			79.5		41.0	57.7

[1] See Appendix A for definitions of CPUE, PSD, RSD, RSD-P and mean Wr.

Walleye

Management Objective

- maintain a walleye population with a total gill-net CPUE of at least 15 whenever the lake is deep enough to minimize the risk of fish kills

Management Strategy

- stock small walleye fingerlings at the rate of 70/acre (27,720) as needed to achieve the management objective

Walleye gill net CPUE fell to 2.7 in 2015 and remains well below the management objective (Table 8). All walleyes sampled were of quality-preferred length (10-15 in., Figure 2). Considering the severe 2013 winterkill, these fish likely originated from the 2013 stocking (Table 9). The lack of sub-stock length fish (<10 in, Figure 2) suggests the 2014 fry stocking was unsuccessful.

Table 8. CPUE, PSD, RSD-P, and mean Wr for all walleye sampled with gill nets in Oak Lake, Brookings County, 2006-2015. Stocked years are shaded.

	2006	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***
CPUE		24.0		10.0			13.0		6.3	2.7
PSD		48		100			88		0	--
RSD-P		3		3			0		0	--
Mean Wr		101		100			89		93	--

Table 9. Walleye stocked into Oak Lake, Brookings County, 2006-2015.

Year	***Number***	***Size***
2006	40,000	Small Fingerling
2009	20,000	Small Fingerling
2010	40,800	Small Fingerling
2013	39,930	Small Fingerling
2014	400,000	Fry
2015	28,160	Small Fingerling

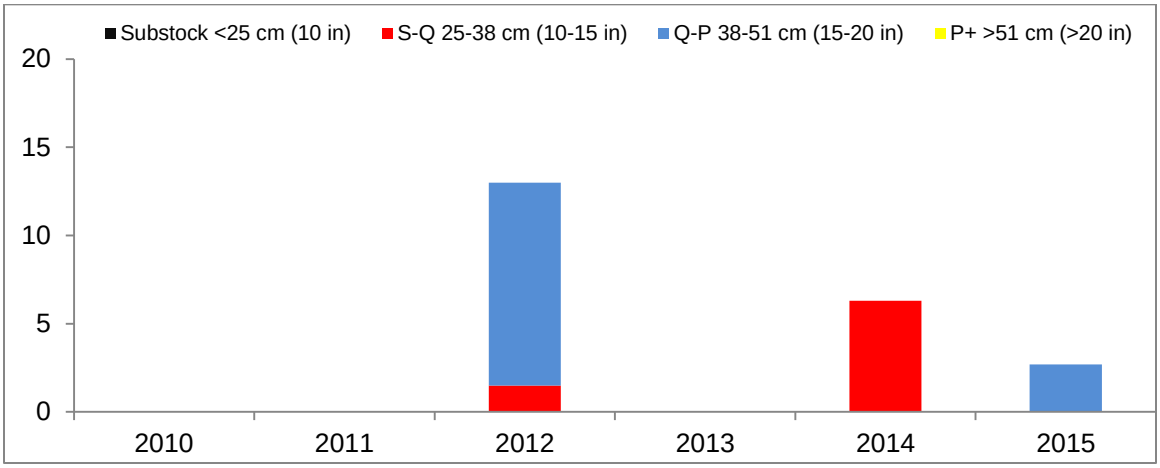

Figure 2. CPUE by length category for walleye sampled with gill nets in Oak Lake, Brookings County, 2010-2015.

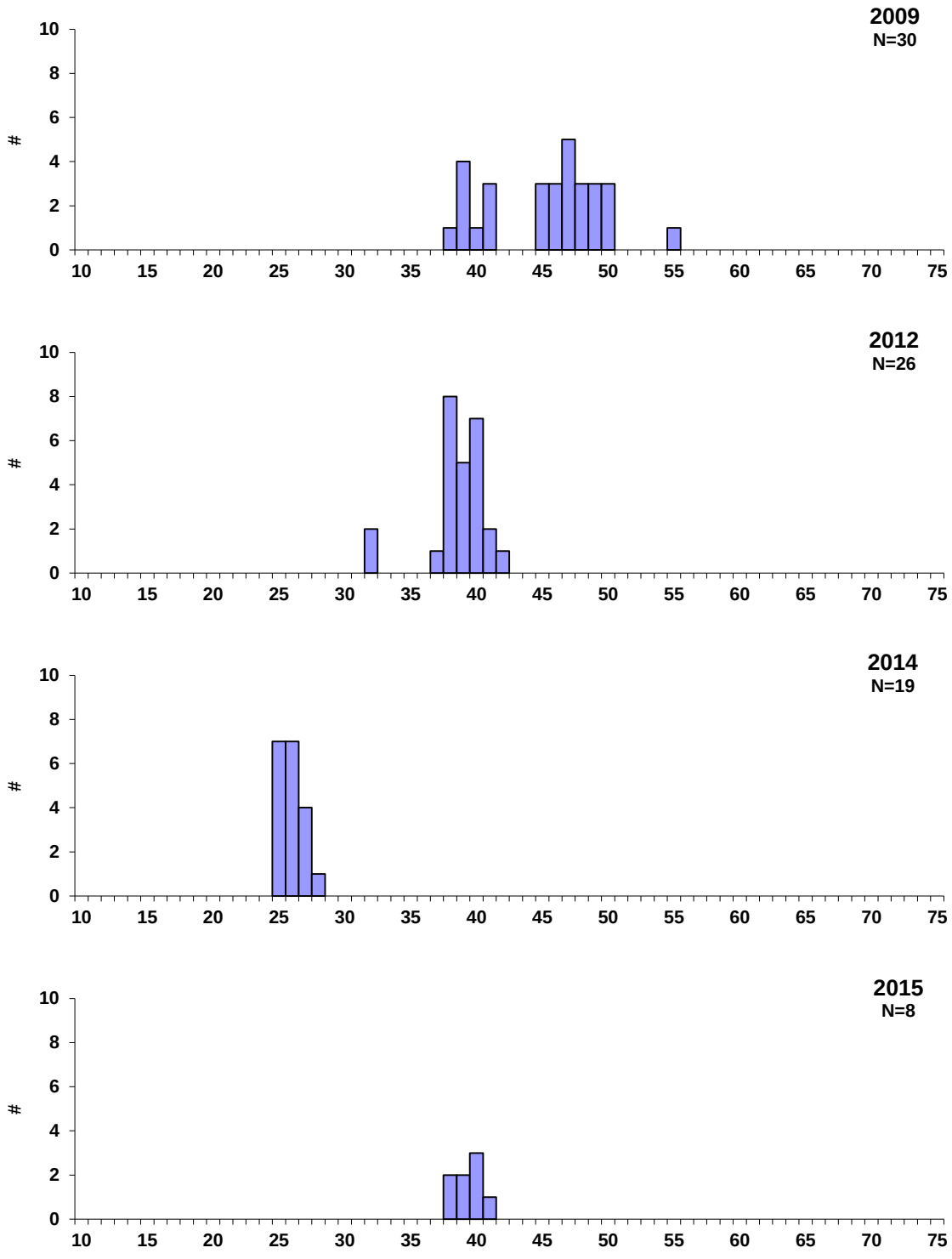

Figure 3. Length frequency histograms for walleye sampled with gill nets in Oak Lake, Brookings County, 2009, 2012, 2014 and 2015.

Yellow Perch

Management Objective

- maintain a yellow perch population with a total gill net CPUE of at least 50 whenever the lake is deep enough to minimize the risk of fish kills

Management Strategies

- stock small fingerling yellow perch at the rate of 500/acre (198,000) as needed to achieve the management objective
- mark all, or a portion of, the stocked fish with oxytetracycline to facilitate stocking evaluation

Yellow perch gill net CPUE rose above the management objective to 57.7 fish per net in 2015 (Table 10). The majority of yellow perch sampled were in the stock-quality length range (5-8 in., Figure 4). The presence of larger fish in the catch (Figure 5) suggests quite a few perch survived the 2013 winterkill.

Table 10. CPUE, PSD, RSD-P, and mean Wr for all yellow perch sampled with gill nets in Oak Lake, Brookings County, 2006-2015. Stocked years are shaded.

	2006	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***
CPUE		8.0		15.7			79.5		41.0	57.7
PSD		48		14			3		22	17
RSD-P		1		3			0		2	0
Mean Wr		92		109			79		91	104

Table 11. Yellow perch stocked into Oak Lake, Brookings County, 2006-2015.

Year	***Number***	***Size***
2006	4,170	Juvenile
2009	7,153	Juvenile
	198,380	Fingerling
2012	3,053	Adult
2013	1,440,000	Fry

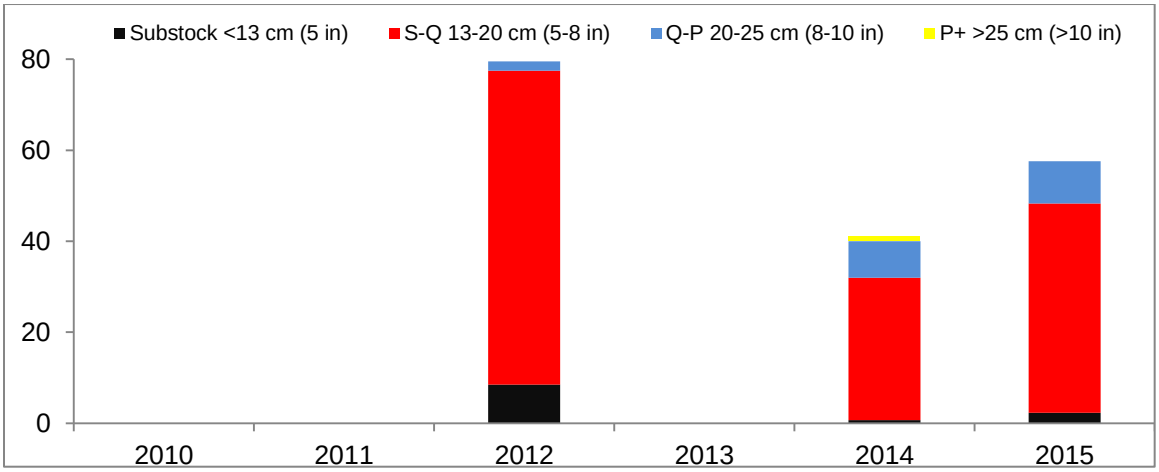

Figure 4. CPUE by length category for yellow perch, sampled with gill nets in Oak Lake, Brookings County, 2010-2015.

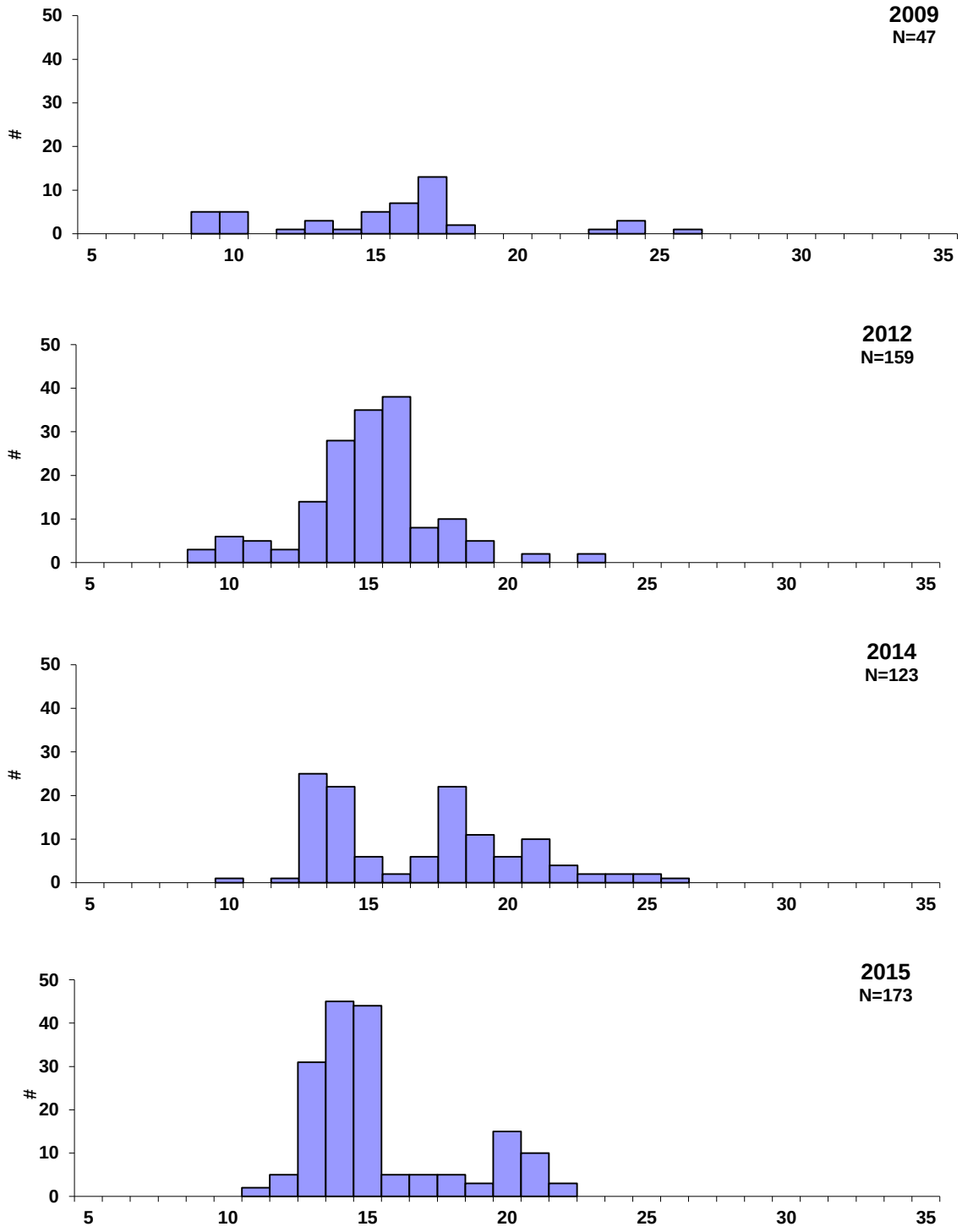

Figure 5. Length frequency histograms for yellow perch sampled with gill nets in Oak Lake, Brookings County, 2009, 2012, 2014 and 2015.

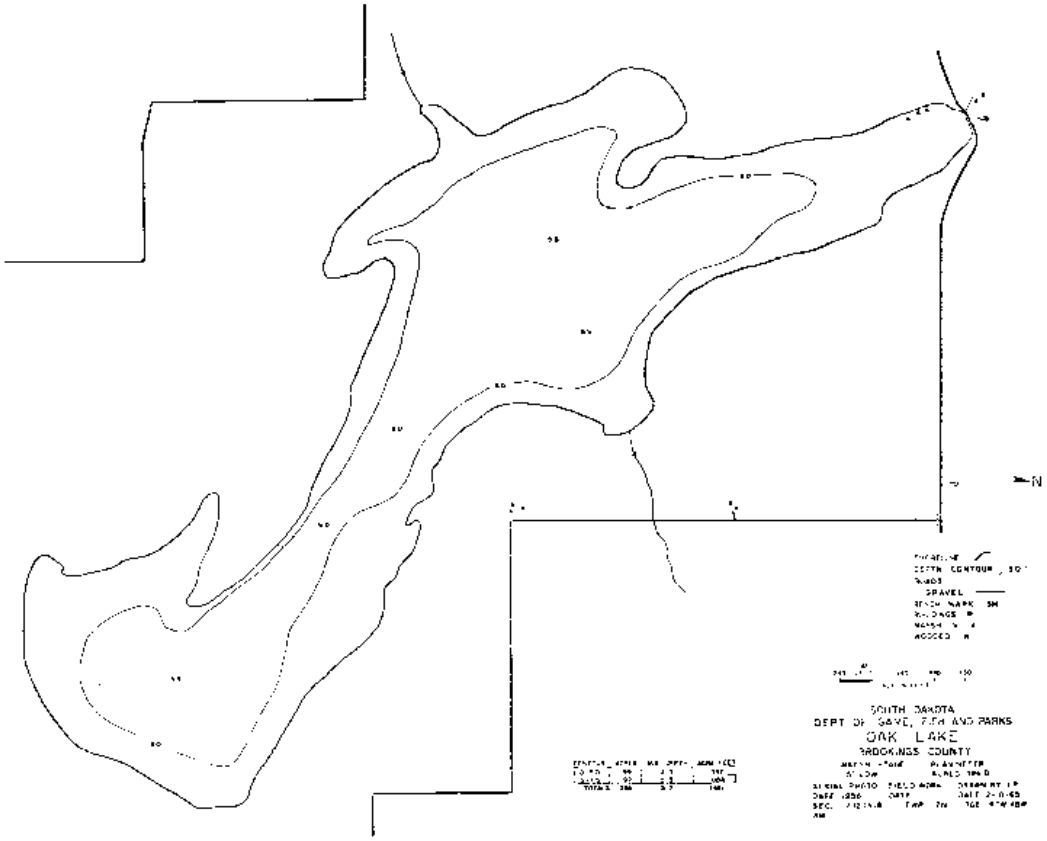

Figure 6. Contour map of Oak Lake, Brookings County.

Appendix A. A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

Catch per Unit Effort (CPUE) is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

$$PSD = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Relative Stock Density (RSD-P) is calculated by the following formula:

$$RSD\text{-}P = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters (Inches in parenthesis).

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25 (10)	38 (15)	51 (20)	63 (25)	76 (30)
Yellow perch	13 (5)	20 (8)	25 (10)	30 (12)	38 (15)
Black crappie	13 (5)	20 (8)	25(10)	30 (12)	38 (15)
White crappie	13 (5)	20 (8)	25(10)	30 (12)	38 (15)
Bluegill	8 (3)	15 (6)	20 (8)	25 (10)	30 (12)
Largemouth bass	20 (8)	30 (12)	38 (15)	51 (20)	63 (25)
Smallmouth bass	18 (7)	28 (11)	35(14)	43 (17)	51 (20)
Northern pike	35 (14)	53 (21)	71 (28)	86 (34)	112 (44)
Channel catfish	28 (11)	41 (16)	61 (24)	71 (28)	91 (36)
Black bullhead	15 (6)	23 (9)	30 (12)	38 (15)	46 (18)
Common carp	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)
Bigmouth buffalo	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)

For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

Relative weight (Wr) is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.